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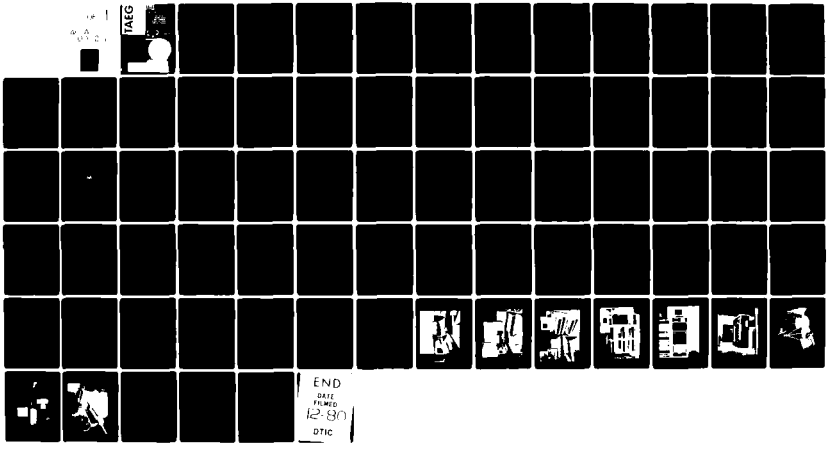

TAEG

TRAINING ANALYSIS AND EVALUATION GROUP

LEVEL II

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TECHNICAL REPORT NO. 91

APPLICATION OF RANDOM ACCESS VIDEO PROGRAMS IN NAVY ELECTRONIC WARFARE TRAINING

SEPTEMBER 1980

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TAEG Report No. 91

APPLICATION OF RANDOM ACCESS VIDEO PROGRAMS IN NAVY ELECTRONIC WARFARE TRAINING

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Training Analysis and Evaluation Group

September 1980

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report presents the results of one aspect of the development of the Navy Consolidated Electronic Warfare (EW) Operator Training Program. It focuses on the efforts of the Training Analysis and Evaluation Group in developing interactive instructional television training programs for EW signal recognition training.

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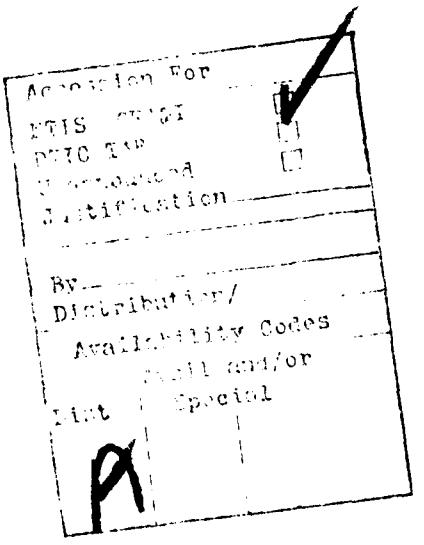

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SECTION I

INTRODUCTION

BACKGROUND

The Navy is consolidating basic Electronic Warfare (EW) training at the Naval Technical Training Center (NAVTECHTRACEN), Pensacola, Florida. The major consolidation milestones already achieved include:

- feasibility studies (1972-1974)
- transfer of surface and air EW training components to NAVTECHTRACEN, Pensacola (1975)
- interim curriculum development (1975-1977)
- multistation EW operator training device (Device 10H1) procurement initiated (1976)
- Instructional Program Development (IPD) Branch established at NAVTECHTRACEN, Pensacola (1977).

The Training Analysis and Evaluation Group (TAEG) has been a participant in the EW consolidation program since 1972 (TAEG Report No. 4, 1972; Pearson, Mac Keraghan, Stubbs, and Moore, 1974a, 1974b; Pearson and Moore, 1975; Pearson, Mac Keraghan, and Stubbs, 1978). This participation was further broadened in 1977 when the IPD Branch was established and TAEG was assigned the role of IPD manager for the EW operations training instructional systems development (ISD).

During the early stage of the EW operations instructional systems development, TAEG conducted an analysis (Platt and Stubbs, 1978) to determine the most appropriate media (in addition to Device 10H1) for delivery of the instructional materials. This analysis determined that training objectives specified for EW signal analysis and signal recognition training could be best satisfied by media possessing dynamic (motion) presentation capability and synchronous audio. Additionally, capability for rapid access to instruction in serial and nonserial fashion was a desired feature. Ease and cost of maintaining and updating perishable EW instructional materials were additional considerations. Video players with random access capability were selected by TAEG as best meeting the training objectives for EW signal analysis and signal recognition training.

PURPOSE

This report (1) presents the delivery medium selected and rationale for use of the video media for application in EW training, (2) describes the video system selected for the Consolidated Navy EW School (CNEWS) for the benefit of those activities which may select similar media implementation, and (3) reports on the implementation of previous EW related TAEG reports (TAEG Report No. 4, 1972; Pearson, Mac Keraghan, and Stubbs, 1978) and associated planning.

ORGANIZATION OF THE REPORT

In addition to this introduction, this report contains three sections and three appendices.

Section II discusses some characteristics of the EW training task, applicability of video to EW training, and application of video at CNEWS as well as at other activities. Section III addresses the instructional television system components/configuration. Section IV presents findings and recommendations. Appendices A through C provide amplifying data on all curriculum materials and the instructional television system. Appendix A delineates initial lesson topics which will be provided as video taped lessons. Appendix B contains a sample interim student workbook showing, among other things, lesson segment numbers, description, (random access) segment address, and sample student response sheets for the Basic Signal Recognition Techniques and Module 18 (Soviet Air-to-Surface Missile System). Appendix C provides a complete list of components of the production/editing/validation subsystem.

SECTION II

THE VIDEO MEDIUM IN EW TRAINING

CHARACTERISTICS OF THE TRAINING TASK

An important task accomplished by EW surveillance receiver operators is signal analysis. The majority of signals analyzed by these operators are classified as pulse type signals. Some of the more important characteristics of pulse type signals that can be determined by the use of surveillance receivers include:

- pulse width
- pulse repetition frequency
- modulation components accompanying the pulse signal characteristics
- associated audio characteristics of the pulse signal.

Pulse signal characteristics such as those listed above are usually determined by use of the pulse analyzer portion of the EW surveillance receiver. The pulse analyzer is a unit containing a multiple trace, cathode ray tube display (see figure 1), and an audio output. The cathode ray tube allows display of more than one pulse type signal characteristic at a time; e.g., pulse width, pulse repetition frequency, associated modulation. The audio output allows analysis of the pulse type signal audio characteristics.

A trained EW operator can use this information to gain knowledge about the source of the intercepted signal; e.g., threat or friendly, type system (missile guidance radar, air traffic control radar, fire control radar), status (launch mode, search mode). The information gained by the EW operator through signal analysis is used by decision makers to develop offensive and/or defensive strategies/tactics.

Electronic Warfare surveillance receiver operators continually search their assigned radio frequency spectrum and identify signals of interest from the many that may be intercepted at any given time. Signals of interest are generally analyzed in detail using the pulse analyzer. During pulse analysis, decisions are called for based on one or more of the pulse type signal characteristics observed. The decision might be:

- stop analysis and look for another signal of interest
- refer to a reference document for additional data
- classify signal
- relay signal data using radio/telephone net.

Numerous factors contribute to any of the decisions of the operator and the more cogent of these must be considered in selecting media for training. Several of these factors and their relationship to the selection of instructional media for training in signal analysis are discussed below.

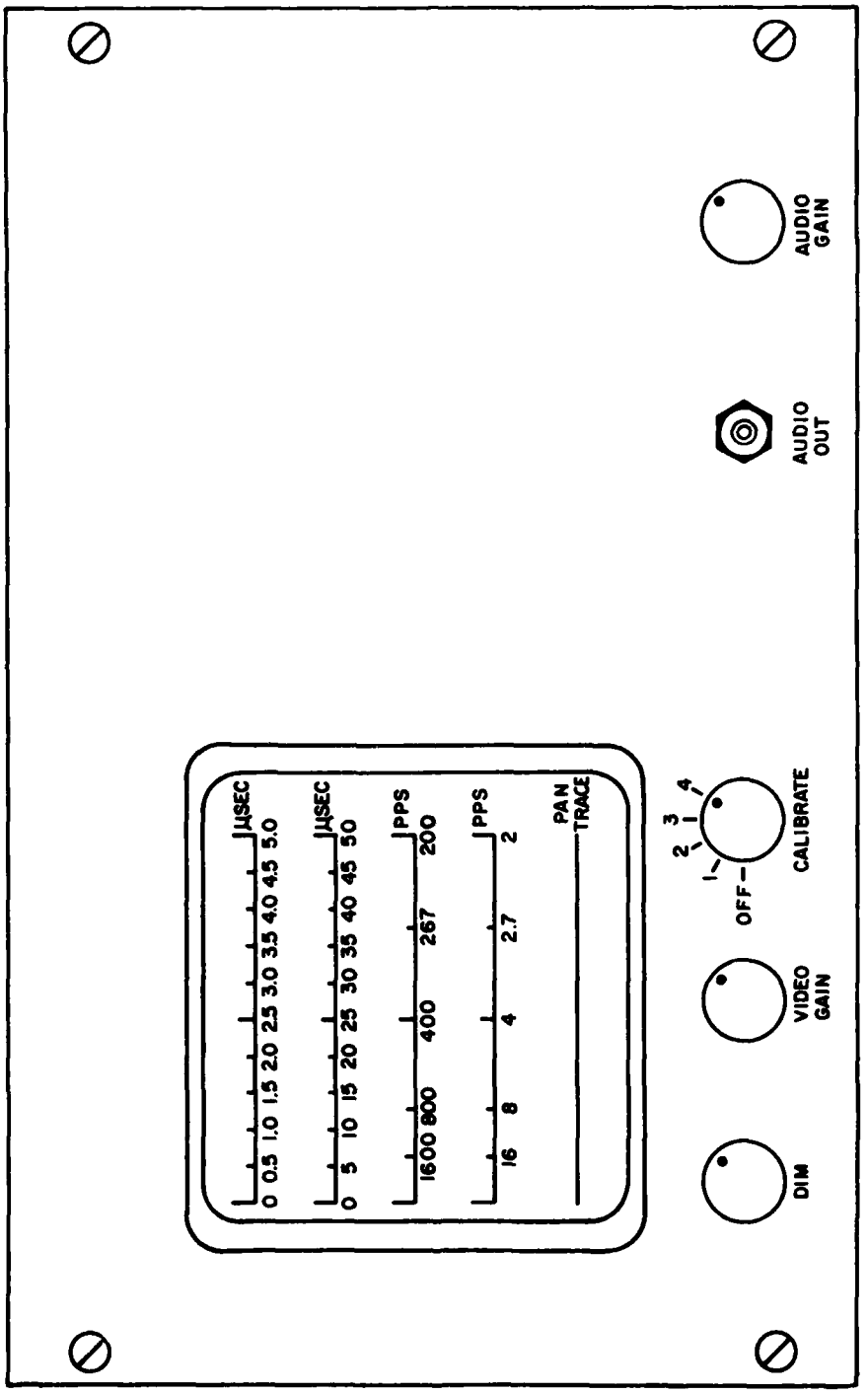

Figure 1. Typical Pulse Analysis Display

APPLICABILITY OF VIDEO TO EW TRAINING

MOTION AND AUDIO. Signals displayed on EW pulse analyzer equipment exhibit considerable motion. Additionally, the aural tones derived from EW signals are in synchronization with the visual display of those EW signals. When a signal is seen on the EW pulse analyzer, it is also heard by the EW operator. These visual and aural "cues" are the "clues" by which the operator recognizes and identifies a particular signal. The ability to display the subtleties of the signal motion on an EW display device and produce synchronous audio is one of the salient features provided by the medium of video.

EASE OF UPDATE. Electronic Warfare (intelligence) data is constantly being collected, refined, updated, and disseminated. When this occurs the changes to the reported signal parametric data are promulgated to all activities concerned. The CNEWS must remain current with the latest data on threat signals if meaningful training is to be achieved. For training purposes, video tape provides the capability of maintaining currency of threat signal parametric data. Unlike motion picture films, for example, video taped lessons can be quickly and relatively easily updated at about one-half the cost of movies (Rhode, Esseff, Pusin, Quirk, and Shulik, 1970). (This cost ratio is still current even though it is approximately a decade old.) Where motion is a requirement and the program data are subject to frequent changes, the cost of video taped lessons is an attractive alternative.

RANDOM ACCESS. The EW surveillance receiver operator has many decision (branch) points in the performance of his signal analysis task which necessitates that the selected training media provide the capability of accessing signal data as dictated by the specific task at hand. Modern random access video tape players allow simulation of signal scenarios for purposes of training this task.

SUBSTITUTE FOR DEVICE 10H1 TRAINING. The "part task" of EW signal analysis can be taught through playback of video tape presentations on a TV monitor or through the use of the instructional and analysis scope displays of Device 10H1. In either case, the manipulation of actual or simulated EW equipment is not required of the student. Since Device 10H1 is primarily an equipment "hands on" oriented training device, its use for signal analysis training would be inappropriate where less costly alternatives exist. Such is the case for the alternative of using video tape presentations. In hardware acquisition cost alone, the approximate $250,000 cost of a 10H1 student station exceeds the $1,900 cost for videocassette player, TV monitor, and auto search control by a factor of 125. Additionally, the amortized cost of video tape signal analysis lessons has averaged $9,000-$10,000 while Device 10H1 Teachware (CAI lessons) could exceed $12,500/lesson (based on 300 hours preparation time for each hour of presentation).

APPLICATION OF VIDEO AT CNEWS

Appendix A provides a list of lesson topics chosen to be taught at CNEWS by random access video tape. It should be noted that all of these lesson topics involve recognition of specific EW signals. That is, the student is required to recognize and identify a particular signal based on the visual and aural cues that are normally provided on typical EW equipment pulse analysis displays. Each lesson topic listed in appendix A is the title to the "main" lesson program (video tape) which contains the signal data and other pertinent information concerning the particular weapon system and/or platform which carries the source (emitter) of the signal(s). In addition, each lesson topic also has a drill and practice tape to assist student long-term memory retention. In the video programs, frequent feedback or knowledge of results is provided in addition to branching for remedial instruction.

Table 1 provides a typical video lesson format. Appendix B contains a sample interim student workbook, for a typical lesson module, showing lesson segment numbers, segment descriptions, (random access) segment addresses, and sample student response sheets. The example shown is for the Basic Signal Recognition Techniques and for curriculum Module 18 (Soviet Air-to-Surface Missile Systems). A similar workbook is provided with each module of instruction listed in appendix A. Random access/branching capabilities are demonstrated on page 30 of appendix B (Random Access Address Log), where the address for each lesson segment is provided.

In a typical application, if a student wanted to go directly to segment 16, Signal Observation/Measurement Techniques, the student would first obtain the segment 16 address from either the Random Access Address Log and/or would be instructed by the video tape to proceed to segment address "2689." The student would then enter that address number in the Auto Search Control Unit (similar to a handheld calculator) and then press the "Search" pushbutton. The videocassette player will then automatically switch into the fast forward or fast reverse mode, as appropriate, to proceed to that address number. Upon reaching the "2689" address, the videocassette player will resume its normal playing/viewing speed unless the student also "instructed" the player to pause upon reaching the desired address. The student, at any time, may pause the tape and utilize the stop-frame capability of the player to more closely observe any item of interest on the video tape. A multiple choice test question, for example, might require the stop-frame (pause) capability. Once the student answers the question, the videocassette player should be commanded by the student to resume normal playing operations. Knowledge of results would immediately follow and/or provide any required remediation instructions.

APPLICATION OUTSIDE OF CNEWS

While the video taped lessons were developed for CNEWS (for which random access videocassette players were procured), the lessons should be of considerable interest and value to many fleet units that may not have such random access equipment capabilities. In addition, even though the EW video taped lessons are designed primarily for use on a random access videocassette player, they can be utilized on video playback machines which do not have this capability, although such utilization would not be optimum. The only

TABLE 1. TYPICAL VIDEO LESSON FORMAT

A. INTRODUCTION/TITLES

B. LEARNING OBJECTIVES

C. BACKGROUND

1. Practice Exercises
2. Student Materials
3. Measurement Devices
4. Emitter Values

D. MISSILE(S)

1. Characteristics
2. Flight Profile

E. LAUNCH PLATFORM(S)

1. Background Information
2. Characteristics

F. MISSILE(S)

1. Operational Profile
2. Associated Radar(s)

G. ASSOCIATED SIGNALS--SEQUENCE

1. Five trace activity scope (Frequency--digital display)
2. Still photo or freeze frame (Pulse Duration)
3. Short segment of live footage
4. Still photo or freeze frame (PRI/PRF--digital display)
5. Short segment live footage
6. PRI to PRF conversion--electronic character generated
7. Scan type/rate--animation or art work

H. PRACTICE EXERCISES

I. SCENARIO OR SUMMARY

J. CLOSING

requirement for a fleet unit to view these lessons is to have a 3/4-inch U-matic videocassette player. In addition, upon request[1] the video taped lessons can be reproduced on other formats such as 1/2-inch Betamax or 1-inch video tape. A copy of each lesson topic listed in appendix A will be provided to the Naval Education and Training Support Center, Pacific, for reproduction to other than 3/4-inch videocassette format.

[1]If other than 3/4-inch U-matic videocassette format is required, requests (specifying desired format) should be addressed to: Commanding Officer, Naval Education and Training Support Center, Pacific, ATTN: NASTAD, San Diego, CA 92147.

SECTION III

INSTRUCTIONAL TELEVISION SYSTEM CONFIGURATION

INTRODUCTION

Considerable planning was necessary prior to initiating procurement of the instructional television system and its subcomponents. Some of the factors considered were: Department of Defense (DOD) and Navy requirements and restrictions, student loading demands, production/editing/validation requirements, TV and photographic equipment needs, and video playback equipment requirements or specifications. These are discussed in more detail below.

DOD AND NAVY REGULATORY REQUIREMENTS. Both DOD and Navy regulations require that 3/4-inch U-Matic video tape format be utilized in formal school environments. There are several minor exceptions to this regulation but none applied to the CNEWS plans. Use on board submarines is one example of an exception. Original plans had been to utilize the capabilities of the 1/2-inch Betamax format, primarily for two reasons: (1) Betamax equipment was the only equipment at the time which could provide random access and (2) Betamax equipment and tapes were lower in price than the 3/4-inch U-Matic equipment and tapes. Betamax video tapes, for example, are approximately one-half the cost of U-Matic tapes.

In order to comply with the existing regulations, however, TAEG invited representatives from the videocassette player industry to discuss application of the random access capability in 3/4-inch U-Matic videocassette format. Once industry was aware of a specific requirement for use of random access 3/4-inch U-Matic videocassette equipment in the EW IPD program, units were available on the GSA schedule in a matter of months. Sony model VP-2011 with the model RM-300 auto search control was the unit procured.

STUDENT LOADING DEMANDS. An analysis was made of the number of students, different types of students (e.g., NFOs, CTTs, EWs), and the student loading factors projected for the self-paced, individualized EW curricula. The results indicated that 120 VP-2011 videocassette players, TV monitors, and auto search controls would be needed to satisfy the student loading requirements. Table 2 indicates the total CNEWS student input requirements by fiscal year in terms of the number and types of students. The number of students at the school was the major factor used to determine the required number of videocassette players, TV monitors, and auto search controls. Other factors considered were: (1) the number of signal recognition lessons that each type of student would be required to take, (2) the length of the lessons, and (3) the distribution of students in the pipeline (e.g., do they come in groups of 20-30, or do they "trickle" in/out individually?).

PRODUCTION/EDITING/VALIDATION SUBSYSTEM. The size of the school, the number of students, and the number of TV programs (and duplicates) also impact on the type and number of equipments required for production/editing/validation. Figure 2 shows the video subsystem configuration/functional flow diagram for video lesson production, editing and validation. From a functional viewpoint, it shows how a typical video lesson is produced using the various components

TABLE 2. STUDENT INPUTS BY FISCAL YEAR

Student Type	FY 81	FY 82	FY 83	FY 84
SLQ-32 R	148	226	284	276
SLQ-17 R	8	10	15	21
WLR-8 R	6	11	17	27
WLR-1 R	318	194	124	88
SLQ-32 F	142	158	130	82
SLQ-17 F	8	13	15	23
WLR-8 F	7	13	15	27
CTT ELINT	100	100	100	100
AVEW	72	72	72	72
EA6 PIPREP	30	30	30	30
VQ EVAL	34	34	34	34
EA6 ECMO	43	43	43	43
VAQ-33	8	8	8	8
EA6 MARINE	16	16	16	16
ASW/TACAIR	64	64	64	64
VQ PILOT	30	30	30	30
ET (SU)	86	86	86	86
TOTALS	1,120	1,108	1,083	1,027

Note: The above figures do not include those students enrolled in any EW equipment maintenance course. They indicate EW operations courses only.

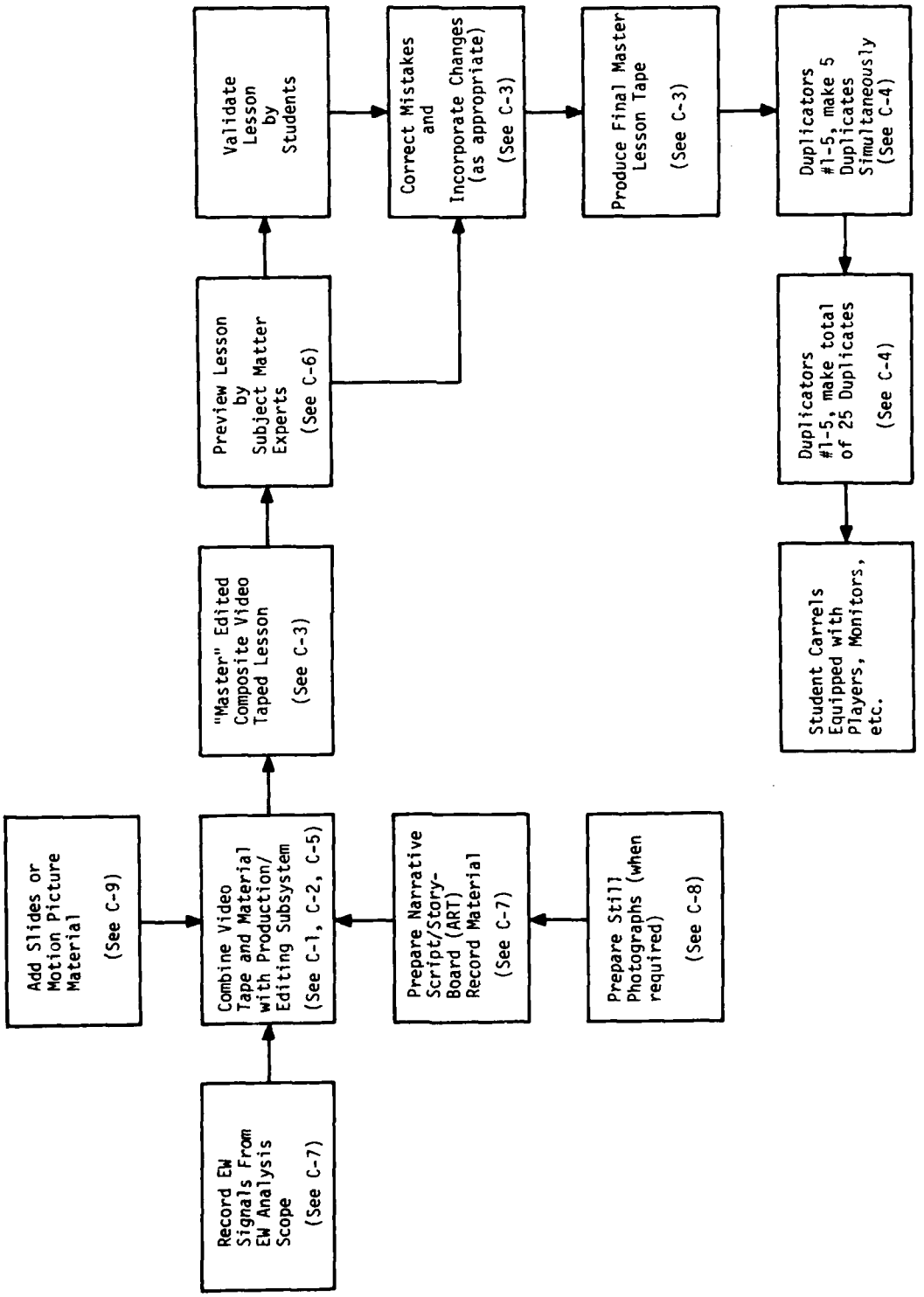

Figure 2. Functional Video System Configuration/Diagram for Video Lesson Generation Flow

of the video subsystem which are discussed in subsequent paragraphs and shown in appendix C. The alphanumeric designation shown in parentheses in each functional block refers to a photograph found in appendix C. Appendix C provides a list of the major components comprising the production/editing/validation subsystem. Also found in appendix C are photographs of the production console (figures C-1 and C-2). The CRT terminal on the far left side in these photographs is the electronic character generator, the utilization of which is more cost effective than conventional artwork when presenting alphanumerics/graphics. Since 25 copies of each master video tape are required to satisfy the student loading requirements, five video recorder/reproducers were procured to satisfy the duplication demand. Figure C-3 shows the editing package (subsystem), while figure C-4 shows duplication (dubbing) units. The rack of equipments on the far right in figure C-4 is shown more clearly in figure C-5. This main electronics rack contains most of the ancillary electronics units such as a video time base corrector, camera control unit, a monitor, an oscilloscope/vector scope, and a patch panel. These equipments are used to test, adjust, and maintain proper TV signals. Figure C-6 shows the videocassette player, monitor, and auto search control unit which is utilized as a preview subsystem. It should be noted here that video tapes must be reproduced (duplicated) in real time as opposed to two or three times faster than real time for audio tapes. Thus, for example, it will take at least 5 to 6 hours to make 25 duplicates of a 1-hour tape (duplicating five tapes at a time).

TELEVISION AND PHOTOGRAPHIC CAMERA REQUIREMENTS. Several factors had to be considered in the selection of a TV camera which would meet the reproductive quality requirements while operating within the constraints imposed by the nature of the task. First, most of the TV recordings would be made of a typical EW pulse analysis scope located in a darkened or semidarkened room. The traces on this analysis scope, as previously mentioned, are not only dynamic, but they are somewhat dimly illuminated on a white-faced scope. Thus, the TV camera must be sufficiently fast to "see" these analysis scope trace movements without blurring. It was found that lower priced ($9,000-$10,000) cameras did not provide a sharp, clear, well-defined scope trace image for recording. It was determined that the most cost-effective TV camera which met the above requirements was the Hitachi model FP-1020. A listing of this camera and its necessary accessories can be found in appendix C, under Portable Camera. Figure C-7 shows the portable television package which includes a video recorder, portable TV camera, power belt, battery charger, light source, camera tripod, portable cart, and carrying cases.

Because motion is not always required in the EW training programs (e.g., during a discussion of how to read/interpret the values of pulse width or pulse repetition frequency), still photographs sometimes can be utilized in certain portions of each program. In order to meet this photographic requirement, a Mamiya model 645, 2¼" x 2¼" format camera was obtained. A listing of this camera and its accessories can also be found in appendix C under Photographic Equipment. Although not shown, the Mamiya model 645 camera and accessories were utilized to take the photographs in appendix C. A film/print processor was also included to handle the expected large volume of photographic prints used in both the video programs and the narrative/programmed instruction texts being developed for CNEWS. Figure C-8 shows the film/print processor.

Considerable planning and effort has also gone into the use of movie footage of appropriate weapons utilization for each video taped lesson. Most of these classified films were obtained through intelligence sources, and therefore cannot be discussed in this report. The primary reasons for including portions of these kinds of motion pictures are to: (1) increase student interest and motivation, (2) establish lesson material credibility, and (3) provide a means of using previously developed material (e.g., motion pictures or 35mm slides) to the fullest extent possible by showing actual footage of the subject weapon's utilization. For example, missile firing and target impacts can be shown, discussed, and related to the job of the EW operator. The Film Chain unit also listed in appendix C provides for this capability. Figure C-9 shows the film chain unit consisting of a color television camera/monitor, 16mm projector, 8mm projector, and a dual slide projector. In these signal recognition programs, use of the film chain unit has been invaluable in terms of program enrichment. If the movie footage were not included in these training programs, it is likely that the personnel would never see the weapons against which they are being trained to find, recognize/identify and subsequently apply some form of countermeasures. These motion pictures, for obvious reasons, are scarce, difficult to obtain, and limited as to the audience authorized to view them.

VIDEO PLAYBACK EQUIPMENT REQUIREMENTS. One of the major EW curriculum design considerations was to incorporate some of the most cost-effective media into the instructional materials at CNEWS. As previously noted, motion is required to portray the EW signals as closely as possible to those displayed on actual/operational EW displays. The use of branching techniques similar to those found on CAI programs/equipments is also highly desirable. In a self-paced curriculum, branching techniques are some of the most powerful methods of providing the student with a knowledge of results or remediation. Additionally, a stop-frame capability is required to enable the student to stop the tape, for example, on an EW signal and study carefully and/or measure all of its pulse characteristics.

The above requirements were easily satisfied by the Sony VP-2011 videocassette player, the Sony RM-300 auto search control, and a TV monitor which would not radiate the classified EW signals and narrative information (TEMPEST approved). The units can be easily mounted in a study carrel.

SECTION IV

FINDINGS AND RECOMMENDATIONS

While the required lesson topics were easily identified, deriving the cost for interactive TV lesson materials was not so easily accomplished. This was due to the lack of historical data for interactive television lesson material development. Since existing cost data could not be located, TAEG, in collaboration with the Naval Training Equipment Center (Audio-Visual Media Branch), generated estimates and submitted them for approval and subsequent project funding. The original cost estimates were $10,000 to $12,000 per lesson.

FINDINGS

A major finding was that the actual cost per lesson of interactive instructional lesson material has averaged between $9,000 and $10,000.

During the validation process of the initial series of lessons, it was found that significant time savings could be effected by using only the video taped lessons. Two student study groups were utilized during the validation process. One group used only the narrative/programmed instructional texts. The second group utilized only the video lesson materials, with no "prerequisite" narrative/programmed instructional texts. Pre- and posttest scores were collected for both groups and compared. It was found that the posttest scores of the student group which used only the video lesson materials were equal to or better than those students' scores who utilized only the narrative/programmed instructional texts. It was found that approximately one-half the time required to complete both the narrative materials and video taped signal recognition lessons could be saved by eliminating the narrative texts/programmed instructional materials which were all normally studied prior to using the video taped lessons. It was concluded that since the posttest scores of both student groups were essentially the same, little was to be gained by requiring students to use the textual materials in addition to the video lessons.

It was also found that most students preferred to use only the video taped lessons. Further, the majority of the students commented favorably on the use of motion picture footage of the missile shots and/or weapons systems about which they were learning. In followup interviews, students indicated a high level of motivation to go on to the next lesson where other informative motion picture footage and weapons systems data would be found. As previously noted, this might be the only time an individual may see these weapons/missile systems employed.

RECOMMENDATIONS

The primary recommendation is that consideration be given to the use of random access video taped lessons, whenever the media selection process (NAVEDTRA 106A, Phase III, pp. 106-124, 172-184) indicates its appropriateness. The instructional television system discussed in this report and

delineated in detail in appendix C is appropriately configured for the student loading factors, number of duplicate taped lessons needed, and other requirements at CNEWS. However, should any application factors be different from those discussed in other sections of this report, a different television production/editing/validation subsystem may be indicated. Only a detailed analysis such as that briefly described in this report will suffice in providing the required background information for acquisition of an instructional television system.

It is also recommended that consideration be given to using a videodisc television system. Such a system has faster response times in terms of searching for other branches of instruction or remediation. As the cost of making a videodisc "master" declines, this system will become an attractive alternative. If the required number of disc copies is relatively high and the subject material contained therein is reasonably stable, the videodisc offers a powerful delivery medium, especially when coupled with a microcomputer. This combination could provide all the features discussed in this report plus adding many of the other capabilities found in larger computer aided instruction (CAI) and computer managed instruction (CMI) systems. A cost trade-off analysis would be required to insure cost-effectiveness regardless of whether random access video tapes or videodiscs are found to be potentially powerful delivery media.

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APPENDIX A

INITIAL LIST OF VIDEO LESSON TOPICS

LESSON TOPIC LIST

Lesson Topic No.	Title
15.1	Soviet Landbased Early Warning and GCI Systems
15.2	Soviet Landbased AAA Systems
15.4	Soviet SA-2 Missile System
15.5	Soviet SA-3 Missile System
15.6	Soviet SA-4 Missile System
15.7	Soviet SA-5 Missile System
15.8	Soviet SA-6 Missile System
15.9	Soviet SA-7/SA-8/SA-9 Missile Systems
15.10	Free World Sam Systems
16.1	Soviet Coastal Defense Missile Systems
17.1	Sino Soviet Naval Shipborne Search and Early Warning Systems
17.3	Soviet SA-N-1 Missile System
17.5	Soviet SA-N-3 Missile System
17.6	Soviet SA-N-4 Missile System
17.7	Soviet Shipborne Fire Control Systems
17.8	Free World Naval Sam/Fire Control Systems
17.10	Soviet SS-N-2 Missile System
17.11	Soviet SS-N-3 Missile System
17.12	Soviet SS-N-7 Missile System
17.13	Soviet SS-N-9 Missile System
17.15	Soviet SS-N-12 Missile System
17.16	Soviet SS-N-14 Missile System
17.17	Soviet SS-N-15, 16 Missile Systems

LESSON TOPIC LIST (continued)

Lesson Topic No.	Title
17.18	Soviet Submarine Launched Ballistic Missile Systems
18.3	Soviet AS-1 Missile System
18.4	Soviet AS-2 Missile System
18.5	Soviet AS-3 Missile System
18.6	Soviet AS-4 Missile System
18.7	Soviet AS-5 Missile System
18.8	Soviet AS-6 Missile System
18.9	Soviet AS-7 Missile System
18.10	Soviet AS-X-8,9 Missile Systems
18.11	Soviet AS-X-10 Missile System
19.2	Soviet AA-1 and AA-2 Missile Systems
19.3	Soviet AA-3, AA-5, and AA-6 Missile Systems
19.4	Soviet AA-7 and AA-8 Missile Systems

APPENDIX B

SAMPLE INTERIM STUDENT WORKBOOK FOR BASIC SIGNAL RECOGNITION TECHNIQUES AND MODULE 18, SOVIET AIR-TO-SURFACE MISSILE SYSTEMS

TAEG Report No. 91

SECRET

NOFORN

(UNCLASSIFIED WHEN NOT FILLED IN)

CONSOLIDATED NAVAL ELECTRONIC WARFARE SCHOOL

BASIC SIGNAL RECOGNITION TECHNIQUES AND MODULE 18 SOVIET AIR-TO-SURFACE MISSILE SYSTEMS

INTERIM AUDIO/VISUAL

STUDENT WORKBOOK

Produced For
CHIEF OF NAVAL EDUCATION AND TRAINING
By
NAVAL TRAINING EQUIPMENT CENTER
ORLANDO, FLORIDA
JANUARY 21, 1980

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NOFORN

INTRODUCTION

This interim student workbook contains a Random Access Address Log, or index, for each of the Module 18 and BSRT video tape programs. In addition, answer sheets are provided for the Practice Exercises that are a part of each lesson, and the Drill and Practice Exercise that is associated with each lesson (except BSRT-1). To locate the sheets for a particular lesson, look at the top right-hand corner of the pages, where you will find both the lesson number, and a Device 5F13 number that is used for other purposes. Within each lesson, the sheets are organized as follows:

1. Random Access Address Log;
2. Student Response Sheet (for Practice Exercises within the lesson);
3. Drill and Practice Answer Sheet (for the Drill and Practice Exercise on a separate tape).

To use the Random Access Address Log, look up the segment of the lesson you wish to view, and enter the associated address on your random tape access unit, then press the SEARCH pushbutton.

The answer sheets provide a blank for each of the answers required in the program or Drill and Practice Exercise. To use these sheets, simply fill in the blanks as you answer each question. It is important that you note that as the answer sheets are filled in, they become CLASSIFIED MATERIAL. Follow your learning center instructor's directions regarding the storage and disposition of the filled-in sheets.

RANDOM ACCESS ADDRESS LOG

Kit Title: Basic Signal Recognition Techniques (Lesson Topic BSRT-1)

Kit Number: Device 5F13/1 - BSRT-1

Segment Number	Segment Description	Segment Address
1	Introduction to Lesson	118
2	Lesson Instructions/Required Materials	384
3	Signal-Weapon Relationships	574
4	Practice Exercise No. 1	715
5	Practice Exercise No. 2	805
6	ELINT Notation	913
7	Signal Characteristics (Peak/Typical Values)	957
8	Practice Exercise No. 3	1083
9	PRI-PRF Relationships	1202
10	PRI to PRF Conversion	1604
11	Practice Exercise No. 4	1837
12	Signal Observation/Measurement Equipment	2013
13	Activity Scope	2038
14	Analysis Scope	2515
15	Pulse Sorter/Analyzer	2515
16	Signal Observation/Measurement Techniques	2689
17	Pulse Duration	2816
18	Practice Exercise No. 5	3012
19	PRI	3287
20	Practice Exercise No. 6	3599
21	Scan Characteristics	3860
22	Bi-Directional Sector Scans	3920
23	Circular Scans	4099
24	Uni-Directional Sector Scans	4171
25	Scan Rate Measurement Techniques	4385
26	Practice Exercise No. 7	5418
27	Practice Exercise No. 8	5504
28	Signal Characteristics Sequences/Pattern Recognition	5675
29	Dual/Multiple RF's	5858
30	Manual Tuning the Receiver	5905

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RANDOM ACCESS ADDRESS LOG

Kit Title: Basic Signal Recognition Techniques (Lesson Topic BSRT-1)

Kit Number: Device 5F13/1 - BSRT-1

Page 2 of 2

Segment Number	Segment Description	Segment Address
1	PRF/Scan Synchronization	5933
2	PRI/PRF Instability	5977
3	Pulse Grouping	6015
4	Summary of Techniques	6243
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Device 5F13/1
Lesson Topic BSRT-1

Student Response Sheet

BASIC SIGNAL RECOGNITION TECHNIQUES (BSRT)

PRACTICE EXERCISE NO. 1

Identify Types of Air, Surface, Subsurface and Land-Based Weapon Systems Using Electronic Systems for Support or Control.

1. _____
2. _____

PRACTICE EXERCISE NO. 2

Identify the Two Key Documents Providing a Major Source of Detailed Signal Characteristics.

A. _____
B. _____

PRACTICE EXERCISE NO. 3

List Characteristics Used for Basic Signal Identification.

A. _____
B. _____
C. _____
D. _____
E. _____
F. _____

Device 5F13/1
Lesson Topic BSRT-1

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Student Response Sheet

BASIC SIGNAL RECOGNITION TECHNIQUES (BSRT)

PRACTICE EXERCISE NO. 4

Calculate PRF's for PRI of
3205 usec and 1000 usec.

1. PRF: _____ pps
2. PRF: _____ pps

PRACTICE EXERCISE NO. 5

Measure and Record Signal:

1. Pulse Duration: _____ usec
   (at left)
2. Pulse Duration: _____ usec
   (at right)

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Device 5F13/1
Lesson Topic BSRT-1

Student Response Sheet

BASIC SIGNAL RECOGNITION TECHNIQUES (BSRT)

PRACTICE EXERCISE NO. 6

Measure and Record Signal:

Pulse Duration: _____ usec

PRI: _____ usec

PRACTICE EXERCISE NO. 7

List Three Basic Tools Used to Determine Scan Type and Rate:

A. _____

B. _____

C. _____

PRACTICE EXERCISE NO. 8

Measure and Record Horizontal Bi-Directional Sector Signal:

Scan Rate: _____ sps

RANDOM ACCESS ADDRESS LOG

Kit Title: Soviet AS-2 Missile Associated Emitter/Signal Recognition (Lesson Topic 18.4)

Kit Number: Device 5F13/2, Part 1

Page 1 of 2

Segment Number	Segment Description	Segment Address
1	Introduction to Lesson	120
2	Launch Platform Description	340
3	Missile Characteristics	430
4	Mission Profile	606
5	Practice Exercise No. 1	875
6	Acquisition and Tracking Radar -	
7	Acquisition Mode:	978
8	Frequency	1040
9	Pulse Duration	1300
10	PRI/PRF	1433
11	Peak Values	1600
12	Scan	1690
13	Practice Exercise No. 2	1920
14	Acquisition and Tracking Radar -	
15	Track Mode:	2220
16	Pulse Duration	2290
17	PRI/PRF	2360
18	Scan	2510
19	Search/Acquisition Mode Summary	2706
20	Track/Lock Mode Summary	2798
21	Practice Exercise No. 3	2910
22	Command Signal	3190
23	Modes	3236
24	Frequency	3313
25	Mode 1 Pulse Structure	3432
26	Pulse Duration	3546
27	PRI/PRF	3620
28	Mode 2 Pulse Structure	3730
29	Pulse Duration	3798
30	PRI/PRF	3823

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RANDOM ACCESS ADDRESS LOG

Kit Title: Soviet AS-2 Missile Associated Emitter/Signal Recognition (Lesson Topic 18.4)

Kit Number: Device 5F13/2, Part 1

Page 2 of 2

Segment Number	Segment Description	Segment Address
1	Scan	3856
2	Summary	3915
3	Practice Exercise No. 4	4080
4	Missile Homing Radar	4332
5	Frequency	4395
6	Pulse Duration	4568
7	PRI/PRF	4620
8	Scan - Acquisition/Track Mode	4710
9	Scan - Lock Mode	4878
10	Summary	4930
11	Practice Exercise No. 5	5020
12	Typical Mission Signal Sequence	5340
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Device 5F13/2, Part 1
Lesson Topic 18.4

Student Response Sheet

SOVIET AS-2 MISSILE ASSOCIATED EMITTER/SIGNAL RECOGNITION

PRACTICE EXERCISE NO. 1

Identify by ELINT Notation the Three Primary AS-2 Associated Signals:

1. A_____
2. A_____
3. A_____

PRACTICE EXERCISE NO. 2

Measure and Record A316Z Signal:

Frequency: _____ MHz

Pulse Duration: _____ usec

PRI: _____ usec

Scan Type: _____

Scan Rate: _____ sps

PRF: _____ pps

PRACTICE EXERCISE NO. 3

Measure and Record A316Z Signal:

Frequency: _____ MHz

Pulse Duration: _____ usec

PRI: _____ usec

Scan Type: _____

Scan Rate: _____ sps

PRF: _____ pps

Device 5F13/2, Part 1
Lesson Topic 18.4

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Student Response Sheet

SOVIET AS-2 MISSILE ASSOCIATED
EMITTER/SIGNAL RECOGNITION

PRACTICE EXERCISE NO. 4

Measure and Record A329Z Signal:

Frequency: _____ MHz

Pulse Duration: _____ usec

PRI: _____ usec

Scan Type: _____

PRF: _____ pps

PRACTICE EXERCISE NO. 5

Measure and Record A374B Signal:

Frequency: _____ MHz

Pulse Duration: _____ usec

PRI: _____ usec

Scan Type: _____

Scan Rate: _____ sps

PRF: _____ pps

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Drill and Practice

Answer Sheet

SOVIET AS-2 MISSILE SYSTEM

EXERCISE NO. 1

Frequency: _____ MHz Scan Type: _____

PD: _____ usec Scan Rate: _____ sps

PRI: _____ usec PRF: _____ pps

EXERCISE NO. 2

Frequency: _____ MHz Scan Type: _____

PD: _____ usec Scan Rate: _____ sps

PRI: _____ usec PRF: _____ pps

EXERCISE NO. 3

Scan Type: _____

Elint Notation: _____

EXERCISE NO. 4

Frequency: _____ MHz PRF: _____ pps

PD: _____ usec Elint Notation: _____

PRI: _____ usec Mode: _____

Scan Type: _____

EXERCISE NO. 5

PRI: _____ usec

PRF: _____ pps

Elint Notation: _____

Mode: _____

EXERCISE NO. 6

Frequency: _____ MHz Scan Type: _____

PD: _____ usec Scan Rate: _____ sps

PRI: _____ usec PRF: _____ pps

EXERCISE NO. 7

Scan Type: _____

Elint Notation: _____

RANDOM ACCESS ADDRESS LOG

Kit Title: Soviet AS-3 Missile Associated Signal Recognition (Lesson Topic 18.5)

Kit Number: Device 5F13/3, Part 1

Page 1 of 1

Segment Number	Segment Description	Segment Address
1	Introduction to Lesson	108
2	Mission Profile	305
3	AS-3 Characteristics	381
4	Operation Profile	590
5	Practice Exercise No. 1	860
6	Signal Detection	935
7	First Signal Recognition	990
8	Practice Exercise No. 2	1335
9	Second Signal Recognition	1600
10	Practice Exercise No. 3	1980
11	Third Signal Recognition	2255
12	Practice Exercise No. 4	2630
13	Summary	2845
14	Conclusion	3320
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Device 5F13/3, Part 1
Lesson Topic 18.5

Student Response Sheet

SOVIET AS-3 MISSILE ASSOCIATED SIGNAL RECOGNITION

PRACTICE EXERCISE NO. 1

1. _____
2. _____
3. _____

PRACTICE EXERCISE NO. 2

Beginning Frame No. 1390
Ending Frame No. 1565

1. RF: _____ MHz
2. PD: _____ usecs
3. PRI: _____ usecs
4. PRF: _____ pps
5. Scan Type: _____
6. Scan Rate: _____ sps

PRACTICE EXERCISE NO. 3

Beginning Frame No. 2035
Ending Frame No. 2220

1. RF: _____ MHz
2. PD: _____ usecs
3. PRI: _____ usecs
4. PRF: _____ pps
5. Scan Type: _____
6. Scan Rate: _____ sps

PRACTICE EXERCISE NO. 4

Beginning Frame No. 2685
Ending Frame No. 2810

1. RF: _____ MHz
2. PD: _____ usecs
3. PRI: _____ usecs
4. PRF: _____ pgps
5. Scan Type: _____
6. Scan Rate: _____

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Device 5F13/3, Part 2
Drill & Practice for
Lesson Topic 18.5

Drill and Practice

Answer Sheet

SOVIET AS-3 MISSILE SYSTEM

EXERCISE NO. 1

RF: _____ MHz PD: _____ usec

PRI: _____ usec PRF: _____ pps

Scan Type: _____ _____ Elint Notation: _____

Scan Rate: _____ sps

EXERCISE NO. 2

PRI: _____ usec PD: _____ usec

Scan Type: _____ _____ PRF: _____ pps

Scan Rate: _____ sps

EXERCISE NO. 3

Scan Type: _____

Scan Rate: _____

EXERCISE NO. 4

RF: _____ MHz PD: _____ usec

PRI: _____ usec PRF: _____ pps

Scan Type: _____ _____ Elint Notation: _____

Scan Rate: _____ sps

EXERCISE NO. 5

PRI: _____ usec PD: _____ usec

PRF: _____ pps

EXERCISE NO. 6

Scan Type: _____

Scan Rate: _____

EXERCISE NO. 7

RF: _____ MHz PD: _____ usec

PRI: _____ usec PRF: _____ pgps

Scan Type: _____ Elint Notation: _____

Scan Rate: _____

RANDOM ACCESS ADDRESS LOG

Kit Title: AS-4 Missile Associated Signal Recognition (Lesson Topic 18.6)

Kit Number: 5F13/4, Part 1

Segment Number	Segment Description	Segment Address
1	Introduction	150
2	Typical AS-4 Mission Profile	340
3	Practice Exercise No. 1	490
4	Missile Variants	590
5	Practice Exercise No. 2	720
6	Target Acquisition	820
7	Missile Launch	900
8	Missile Flight Profiles	965
9	Terminal Homing	1020
10	Practice Exercise No. 3	1090
11	Remedial Summary	1190
12	Practice Exercise No. 4	1280
13	Signal Recognition	1360
14	Platform Acquisition Radar Characteristics	1400
15	Acquisition Radar Dual RF Mode	1675
16	Acquisition Radar Pulse Characteristic Summary	1815
17	Acquisition Radar RF Characteristic Summary	1965
18	Practice Exercise No. 5	2045
19	Missile Radar Characteristics	2350
20	Missile Radar Pulse Characteristic Summary	2500
21	Missile Radar RF Characteristic Summary	2545
22	Practice Exercise No. 6	2630
23	System Signal Profile	2945
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Device 5F13/4, Part 1
Lesson Topic 18.6

Student Response Sheet

SOVIET AS-4 MISSILE SYSTEM

PRACTICE EXERCISE NO. 1

A. The AS-4 missile can be carried by either _____ or _____ aircraft.

B. The _____ may carry up to three AS-4 missiles, while the _____ can carry one.

PRACTICE EXERCISE NO. 2

A. The _____ version

B. The _____ homing version.

C. The _____ homing version.

PRACTICE EXERCISE NO. 3

A. The _____ operating in the _____ band.

B. The _____ operating in the _____ band.

PRACTICE EXERCISE NO. 4

A. The (name classified) radar operates in the _____ band.

B. The (name classified) radar operates in the _____ band.

PRACTICE EXERCISE NO. 5

Frequency: _____ MHz

Pulse Duration: _____ usec

PRI: _____ usec

PRF: _____ Hz

Scan Type: _____

Scan Rate: _____ sps

Elint Notation: _____

PRACTICE EXERCISE NO. 6

Frequency: _____ MHz

Pulse Duration: _____ usec

PRI: _____ usec

PRF: _____ Hz

Scan Type: _____

Scan Rate: _____ sps

Elint Notation: _____

Device 5F13/4, Part 2
Drill & Practice for
Lesson Topic 18.6

DRILL AND PRACTICE

Answer Sheet

SOVIET AS-4 MISSILE SYSTEM

EXERCISE NO. 1

Frequency: _____ MHz
Pulse Duration: _____ usec
PRI: _____ usec
PRF: _____ Hz
Scan Type: _____
Scan Rate: _____ sps
Elint Notation: _____

EXERCISE NO. 2

Frequency: _____ MHz
Pulse Duration: _____ usec
PRI: _____ usec
PRF: _____ Hz
Scan Type: _____
Scan Rate: _____ sps

EXERCISE NO. 3

Frequency: _____ MHz
Pulse Duration: _____ usec
PRI: _____ usec
PRF: _____ Hz
Scan Type: _____
Scan Rate: _____ sps

EXERCISE NO. 4

Frequency: _____ MHz
Pulse Duration: _____ usec
PRI: _____ usec
PRF: _____ Hz
Scan Type: _____
Scan Rate: _____ sps
Elint Notation: _____

EXERCISE NO. 5

Frequency: _____ MHz
Pulse Duration: _____ usec
PRI: _____ usec
PRF: _____ Hz
Scan Type: _____

RANDOM ACCESS ADDRESS LOG

Kit Title: Soviet AS-5 Missile Associated Signal Recognition (Lesson Topic 18.7)

Kit Number: Device 5F13/5, Part 1

Page 1 of 1

Segment Number	Segment Description	Segment Address
1	Introduction to Lesson	125
2	Missile Review	350
3	Signal ELINT Notation Review	650
4	Operation Profile	800
5	Practice Exercise No. 1	1090
6	First Signal Recognition	1280
7	Practice Exercise No. 2	1525
8	Second Signal Recognition	1845
9	Practice Exercise No. 3	2120
10	Third Signal Recognition	2395
11	Practice Exercise No. 4	2625
12	Signal Summary	2880
13	Conclusion	3760
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Device 5F13/5, Part 1
Lesson Topic 18.7

Student Response Sheet

SOVIET AS-5 MISSILE ASSOCIATED SIGNAL RECOGNITION

PRACTICE EXERCISE NO. 1

1. _____
2. _____
3. _____

PRACTICE EXERCISE NO. 2

Beginning Frame No. 1525
Ending Frame No. 1735

1. RF: _____ MHz
2. PD: _____ usecs
3. PRI: _____ usecs
4. PRF: _____ pps
5. Scan Type: _____ _____
6. Scan Rate: _____ sps

PRACTICE EXERCISE NO. 3

Beginning Frame No. 2120
Ending Frame No. 2355

1. RF: _____ MHz
2. PD: _____ usecs
3. PRI: _____ usecs
4. PRF: _____ pps
5. Scan Type: _____
6. Scan Rate: _____ spr

PRACTICE EXERCISE NO. 4

Beginning Frame No. 2625
Ending Frame No. 2840

1. RF: _____ MHz
2. PD: _____ usecs
3. PRI: _____ usecs
4. PRF: _____ pps
5. Scan Type: _____
6. Scan Rate: _____ Hz

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Device 5F13/5, Part 2
Drill & Practice for
Lesson Topic 18.7

Drill and Practice

Answer Sheet

SOVIET AS-5 MISSILE SYSTEM

EXERCISE NO. 1

RF: _____ MHz PD: _____ usec

PRI: _____ usec PRF: _____ pps

Scan Type: _____ Elint Notation: _____

Scan Rate: _____ sps

EXERCISE NO. 2

RF: _____ MHz PD: _____ usec

PRI: _____ usec PRF: _____ pps

Scan Type: _____ _____

Scan Rate: _____ sps

EXERCISE NO. 3

Scan Type: _____

Scan Rate: _____

EXERCISE NO. 4

RF: _____ MHz PD: _____ usec

PRI: _____ usec PRF: _____ pps

Scan Type: _____ Elint Notation: _____

Scan Rate: _____ spr

EXERCISE NO. 5

RF: _____ MHz PD: _____ usec

PRI: _____ usec PRF: _____ pps

Scan Type: _____ _____

Scan Rate: _____ sps

EXERCISE NO. 6

RF: _____ MHz PD: _____ usec

PRI: _____ usec PRF: _____ pps

Scan Type: _____ _____

Scan Rate: _____ sps

EXERCISE NO. 7

RF: _____ MHz PD: _____ usec

PRI: _____ usec PRF: _____ pps

Scan Type: _____ _____

Scan Rate: _____ sps

EXERCISE NO. 8

RF: _____ MHz

PD: _____ usec

PRI: _____ usec

PRF: _____ pps

Scan Type: _____ _____

Elint Notation: _____

Scan Rate: _____ sps, _____ Hz

EXERCISE NO. 9

Scan Type: _____

Scan Rate: _____

RANDOM ACCESS ADDRESS LOG

Kit Title Soviet AS-6 Missile Associated Signal Recognition (Lesson Topic 18.8) Kit Number Device 5F13/6, Part 1

Page 1 of 1

Segment Number	Segment Description	Segment Address
1	*Introduction to Lesson*	145
2	Missile Review	380
3	Signal ELINT Notation Review	590
4	Operation Profile	690
5	Practice Exercise No. 1	1015
6	First Signal Recognition	1150
7	Practice Exercise No. 2	140C
8	Second Signal Recognition	1670
9	Practice Exercise No. 3	2010
10	Third Signal Recognition	2290
11	Practice Exercise No. 4	2520
12	Signal Summary	2770
13	Conclusion	3640
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Device 5F13/6, Part 1
Lesson Topic 18.8

Student Response Sheet

SOVIET AS-6 MISSILE ASSOCIATED SIGNAL RECOGNITION

PRACTICE EXERCISE NO. 1

1. _____
2. _____
3. _____

PRACTICE EXERCISE NO. 2

Beginning Frame No. 1450
Ending Frame No. 1630

1. RF: _____ MHz
2. PD: _____ usecs
3. PRI: _____ usecs
4. PRF: _____ pps
5. Scan Type: _____ _____
6. Scan Rate: _____ sps

PRACTICE EXERCISE NO. 3

Beginning Frame No. 2050
Ending Frame No. 2250

1. RF: _____ MHz
2. PD: _____ usecs
3. PRI: _____ usecs
4. PRF: _____ pps
5. Scan Type: _____
6. Scan Rate: _____ spr

PRACTICE EXERCISE NO. 4

Beginning Frame No. 2560
Ending Frame No. 2735

1. RF: _____ MHz
2. PD: _____ usecs
3. PRI: _____ usecs
4. PRF: _____ pps
5. Scan Type: _____ _____
6. Scan Rate: _____ sps

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Device 5F13/6, Part 2
Drill & Practice for
Lesson Topic 18.8

Drill and Practice

Answer Sheet

SOVIET AS-6 MISSILE SYSTEM

EXERCISE NO. 1

RF: _____ MHz
PRI: _____ usecs
Scan Type: _____ _____
PD: _____ usec
PRF: _____ pps
Scan Rate: _____ sps
Elint Notation: _____

EXERCISE NO. 2

RF: _____ MHz
PRI: _____ usec
Scan Type: _____ _____
PD: _____ usec
PRF: _____ pps
Scan Rate: _____ sps

EXERCISE NO. 3

RF: _____ MHz
PRI: _____ usecs
Scan Type: _____
PD: _____ usec
PRF: _____ pps
Scan Rate: _____

EXERCISE NO. 4

RF: _____ MHz
PRI: _____ usecs
Scan Type: _____
PD: _____ usec
PRF: _____ pps
Scan Rate: _____ spr
Elint Notation: _____

EXERCISE NO. 5

RF: _____ MHz
PRI: _____ usecs
Scan Type: _____ _____
PD: _____ usec
PRF: _____ pps
Scan Rate: _____ sps

EXERCISE NO. 6

RF: _____ MHz
PRI: _____ usecs
Scan Type: _____ _____
PD: _____ usec
PRF: _____ pps
Scan Rate: _____ sps

Soviet AS-6 Missile System - Drill & Practice Answer Sheet

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Device 5F13/6, Part 2
Drill & Practice for
Lesson Topic 18.8

EXERCISE NO. 7

RF: _____ MHz
PRI: _____ usecs
Scan Type: _____ _____

PD: _____ usec
PRF: _____ pps
Scan Rate: _____ sps

EXERCISE NO. 8

RF: _____ MHz
PRI: _____ usecs
Scan Type: _____ _____

PD: _____ usec
PRF: _____ pps
Scan Rate: _____ sps
Elint Notation: _____

EXERCISE NO. 9

RF: _____ MHz
PRI: _____ usecs
Scan Type: _____ _____

PD: _____ usec
PRF: _____ pps
Scan Rate: _____ sps

EXERCISE NO. 10

RF: _____ MHz
PRI: _____ usecs
Scan Type: _____

PD: _____ usec
PRF: _____ pps
Scan Rate: _____

RANDOM ACCESS ADDRESS LOG

Kit Title AS-7 Missile Associated Signal Recognition (Lesson Topic 18.9)

Kit Number 5F13/7, Part 1

Page 1 of 1

Segment Number	Segment Description	Segment Address
1	Introduction	90
2	AS-7 Characteristics and Platforms	320
3	Practice Exercise No. 1	515
4	Platform Ranges	600
5	Radar Characteristics	675
6	Radar Intercept Description	830
7	Search Mode Pulse Characteristics Summary	975
8	Practice Exercise No. 2	1060
9	Track Mode Characteristics	1390
10	Track Mode Pulse Characteristics Summary	1535
11	Practice Exercise No. 3	1705
12	System Signal Profile	2035
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SECRET-NOFORN
(Unclassified When Not Filled In)

Device 5F13/7, Part 1
Lesson Topic 18.9

Student Response Sheet

SOVIET AS-7 MISSILE SYSTEM

PRACTICE EXERCISE NO. 1

A. _____

B. _____ nm

PRACTICE EXERCISE NO. 2

Frequency: _____ MHz

Pulse Duration: _____ usec

PRI: _____ usec

PRF: _____ Hz

PRACTICE EXERCISE NO. 3

Frequency: _____ MHz

Pulse Duration: _____ usec

PRI: _____ usec

PRF: _____ Hz

Scan Type: _____

Scan Rate: _____ Hz

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(Unclassified When Not Filled In)

Device 5F13/7, Part 2
Drill & Practice for
Lesson Topic 18.9

Drill and Practice

Answer Sheet

SOVIET AS-7 MISSILE SYSTEM

EXERCISE NO. 1

Frequency: _____ MHz

Pulse Duration: _____ usec

PRI: _____ usec

PRF: _____ Hz

Scan Type: _____

Elint Notation: _____

EXERCISE NO. 2

Frequency: _____ MHz

Pulse Duration: _____ usec

PRI: _____ usec

PRF: _____ Hz

Scan Type: _____

APPENDIX C

PRODUCTION/EDITING/VALIDATION SUBSYSTEM COMPONENTS

QTY.	MODEL	UNIT DESCRIPTION
PREVIEW PACKAGE		
1	VP-2011	Sony Video Cassette Player
1	RM-300	Auto Search Control
2	PVM-800	Sony 8" Color Monitor
DUPLICATING PACKAGE		
1	RM-444	Sony Master Distributor
1	VO-2860	Sony U-Matic Recorder/Player
1	PVM-1211	Sony Monitor
5	VO-2800	Sony U-Matic Recorder/Player/Editor
1	336	Shintron Video Distribution Amplifier
1	316	Shintron Audio Distribution Amplifier
1	504B	CVS Time Base Corrector
1	528	Tektronix Waveform Monitor
1	V156LBS5-AFB-1	Vicon 6 Position Sequential Switcher
1	1420/OPT1	Tektronix Vectorscope
1	016-0115-02	Tektronix Dual Pack
1	-	ADC Video Patch Panel
1	-	Audio Monitor
2	-	Stantron Cabinets
5	RCC-5C	Sony 8-Pin Cords for RM-444
EDITING PACKAGE		
2	VO-2860	Sony U-Matic Recorder/Player
1	RM-430	Sony Edit Programmer
1	VDC-3	Sony Dub Cable
1	MX-20	Sony Audio & Microphone Mixer
2	CVM-1250	Sony Monitor Receiver
1	ECM-56	Sony Microphone
2	DR-9	Sony Headset
1	-	Winstead Edit & Production Console
1	-	Comprehensive Tape Eraser
-	-	Misc. Cable to Interface Equipment
1	300	Shintron Console
1	902	ISI Special Effects Generator/Switcher
1	1240	ISI Encoded Chromakeyer
1	501	ISI Frame
1	505	ISI Power Supply
1	665	ISI Arrow/Pointer
1	-	ISI Extender Board (For 902)
1	IUV 763	Panasonic Triple 5" B&W Monitor
1	3600A	Laird Character Generator
1	3615A	Laird Keyboard with Memory
1	3685A	Laird Lower Case Characters

QTY.	MODEL	UNIT DESCRIPTION
EDITING PACKAGE (continued)		
1	3690A	Laird Auto-Centering
1	3695A	Laird Character Edging
1	3652A	Laird Pulse Interface
1	3662A	Laird Color Billboard
1	-	Laird 3600A Service Manual
1	TR-920VA	Panasonic 9" B&W Monitor
PORTABLE FIELD EQUIPMENT		
2	VO-3800	Sony Video Recorder
2	MX-650	Sony Microphone Mixer
2	ECM-50PS	Sony Microphone
2	EC-10AMV	Sony Microphone Cord
2	PB-3800	Porta-Brace Cart w/wheel base
2	AC-12	Sony Mixer/Power Supply/Battery
2	4-70150-4	Quick-Set Tripod
2	4-72851-5	Quick-Set Jr. Fluid Head
2	4-76010-4	Quick-Set Dolly
2	SG77	Sylvania Sun Gun
FILM CHAIN		
1	5300	Laird Optical Multiplexer
1	5107	Laird Shelf & Mounting Adapter for Camera
1	5015	Laird 3/8" Lens Extender
1	930LTI	Singer Graflex 16mm TV Film Projector w/Optical Sound & 3" Projection Lens
1	5108	Laird Stand & Mounting Adapter for 930LTI
1	4220	Laird 35mm Dual Drum Dissolve Slide Projector w/7" Projection Lens
1	5107	Laird Shelf for 4220
3	5036	Laird Neutral Density Filter Kit
1	M100A	Laird Super 8 Projector
1	5104	Laird Adapter-Stand
PORTABLE CAMERA		
2	FP-1020	Hitachi Portable Camera consisting of: 1 - Camera Head w/3 Saticon H-9311 Tubes 1 - VM-152 Viewfinder 1 - Grip 1 - Shoulder Mount 1 - VE-103 Image Enhancer V&H 1 - ADR-20C Mount Adaptor

QTY.	MODEL	UNIT DESCRIPTION
PORTABLE CAMERA (continued)		
	FP-1020 (con't.)	1-CL-20 Carrying Case 1-Extender Board 1-PB-20 Power Belt (12V-6AH) 1-BC-20 Rapid Charge Battery Charger (1H) 1-Operation and Service Manual
OPTIONAL ACCESSORIES		
2	N10X10RH	Hitachi Zoom Lens, 10-100mm FL.9, Auto Iris
2	AP-20	Hitachi AC Adaptor
2	-	Hitachi 45' Camera Cable
2	MC-30A	Hitachi Microphone
2	C-20ICE	Hitachi VTR Cable
1	OP-1020	Hitachi Operation Panel
1	GL-1020	Hitachi Gen Lock Unit
FILM CHAIN CAMERA		
1	FP-1011S	Hitachi Color Camera consisting of: 3 2/3" Saticon Tubes Camera Control Unit I&O Encoding Color Bar Generator Color Painting + 6dB Gain Tiltable Viewfinder Built-in Test Signals Automatic Iris Automatic Digital Memory White Balance External Drives - RP-1011 Remote Control Panel, 1-3/4" Master Pedestal, Iris, Color Painting Auto White & Black Balance, Color Bars Intercom, Tally, + 6dB Gain, Color Temperature Switch
OPTIONAL ACCESSORIES		
1	A404	Hitachi Vertical Enhancer Unit
1	ADR-Z	Hitachi Film Chain Lens Adaptor, C Mount
1	-	Hitachi 50mm Lens
1	LE-10	Hitachi Extension Tube
1	A421	Hitachi Gen Lock Unit

QTY.	MODEL	UNIT DESCRIPTION
PHOTOGRAPHIC EQUIPMENT		
1	-	Mamiya M645 Body
1	-	PD Finder for M645
1	-	Mamiya 150mm F4 Lens
1	-	Mamiya 80mm Macro Lens
1	-	Mamiya 45mm Lens
1	-	Auto Macro Spacer
1	-	Deluxe Grip
1	-	Quick Set Tripod Elevator
1	-	58mm Pol. Filter
1	-	77mm Pol. Filter
1	-	Metz 402 Flash Unit
1	-	Image-Maker (Film/Print Processor)

Figure C-1. Production Console

Figure C-2. Production Console and Ancillary Equipment

Figure C-3. Editing Package Subsystem

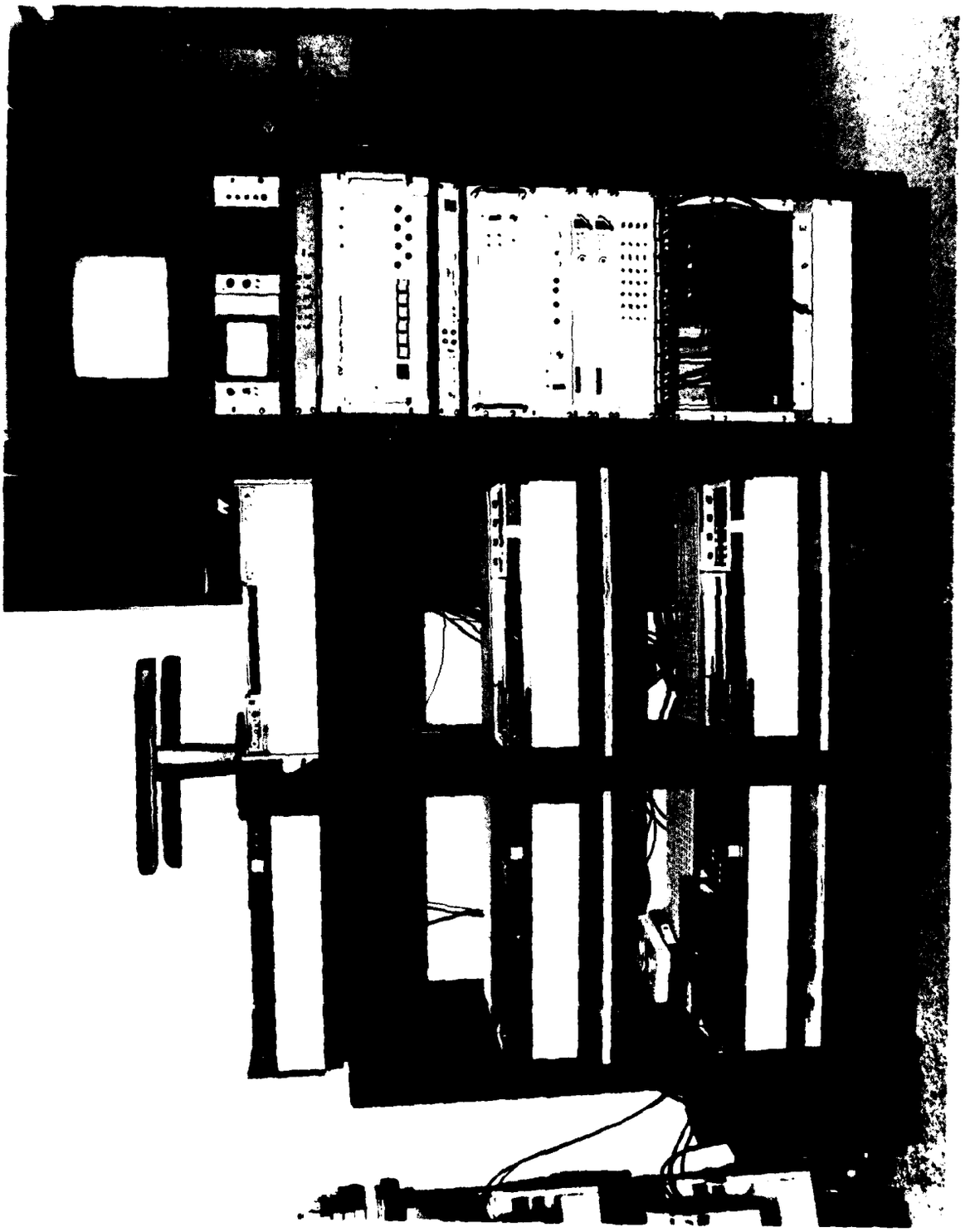

Figure C-4. Duplication (Dubbing) Units

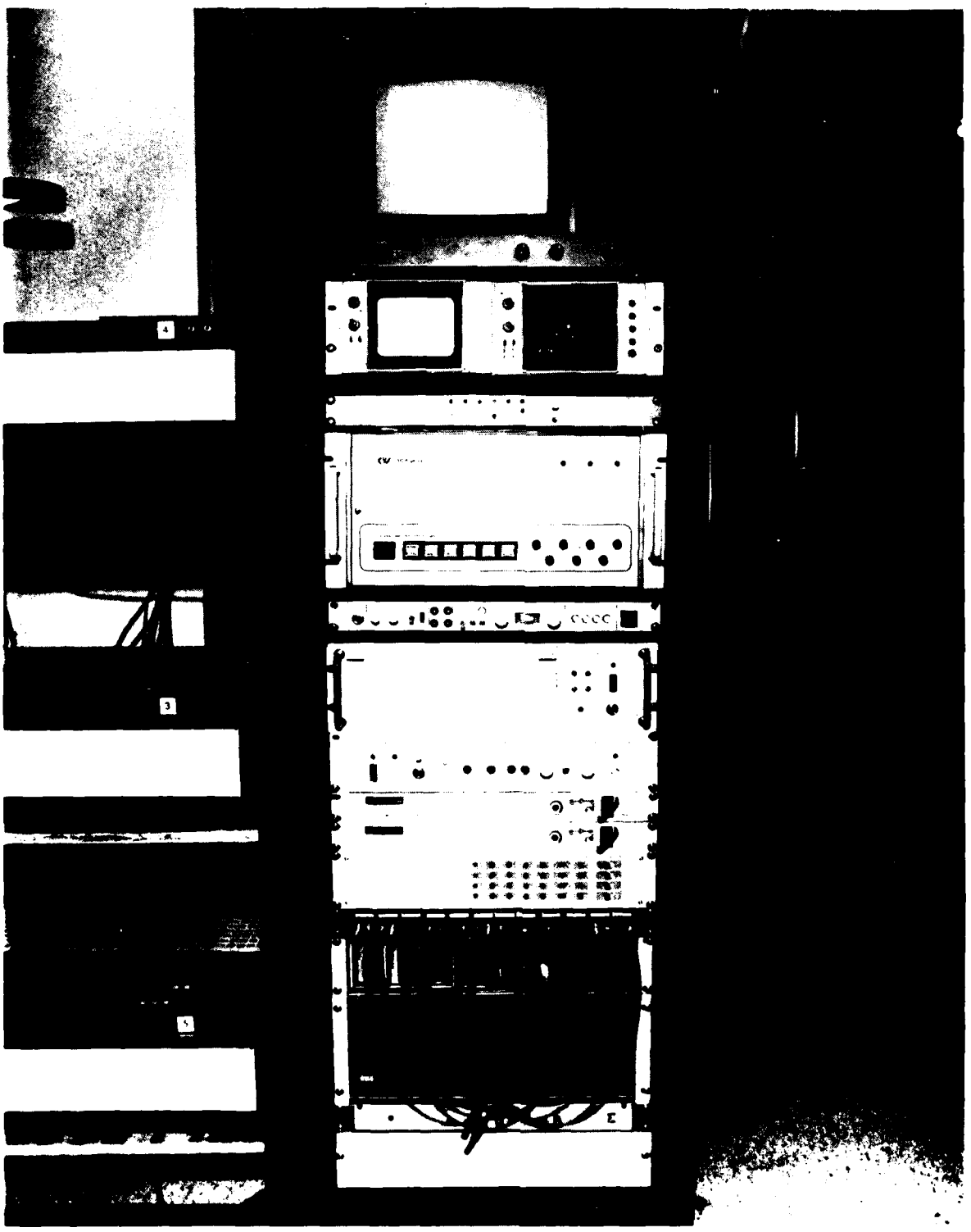

Figure C-5. Electronics Rack of Duplication (Dubbing) Unit Which Contains Most of the Ancillary Electronics Units

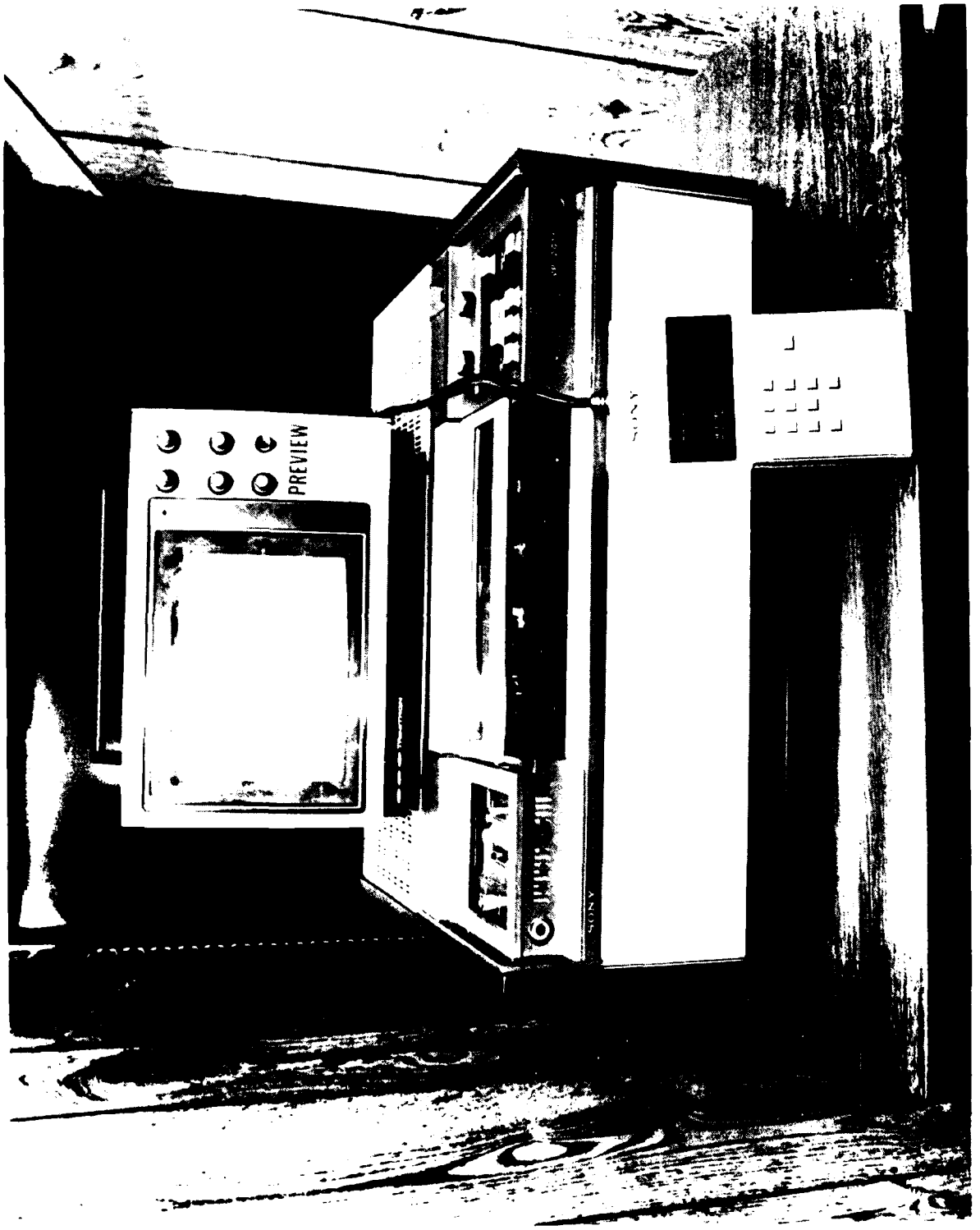

Figure C-6. Videocassette Player, Monitor, and Auto Search Control Unit Utilized as a Preview Subsystem

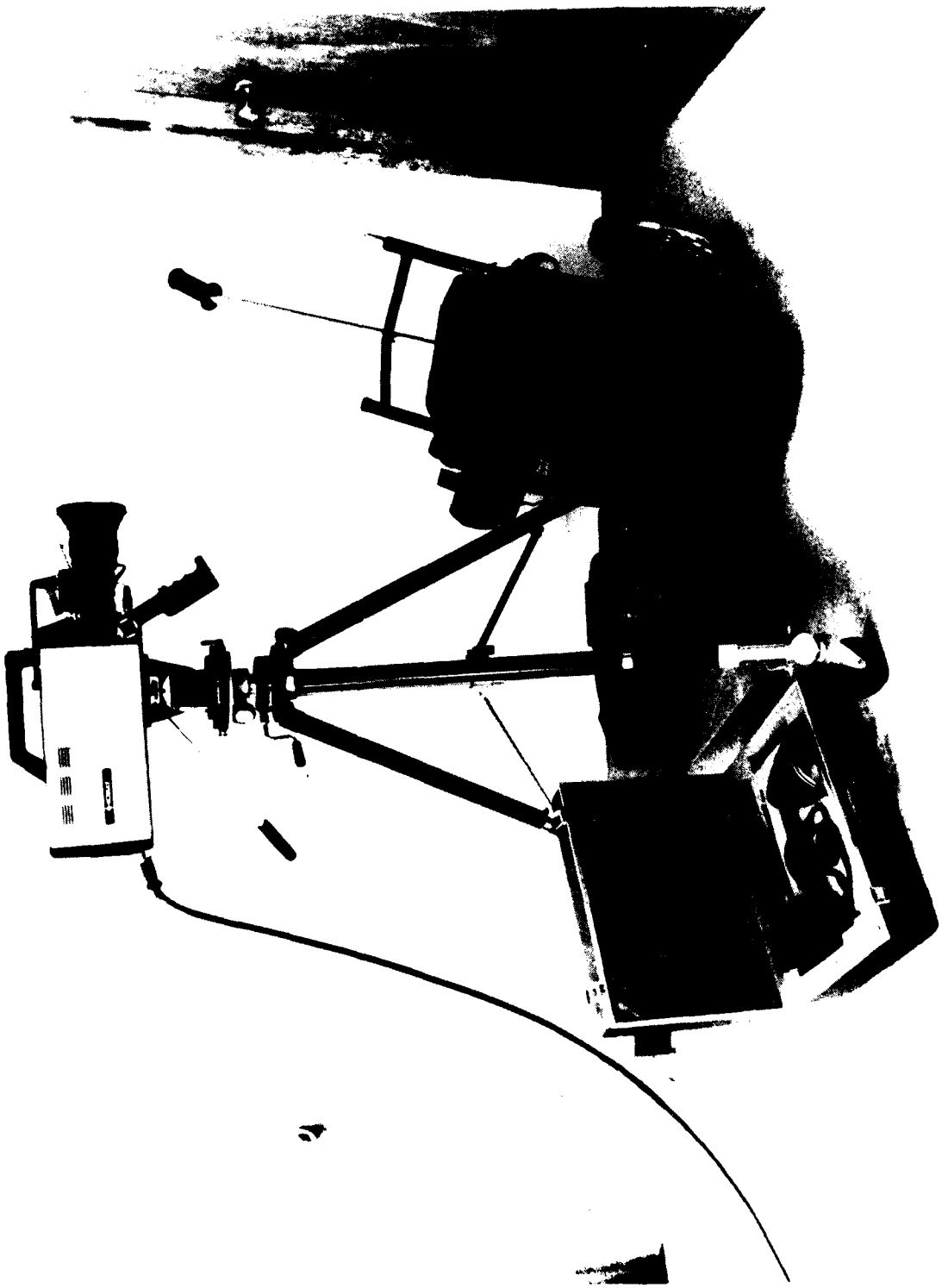

Figure C-7. Portable Television Camera Package

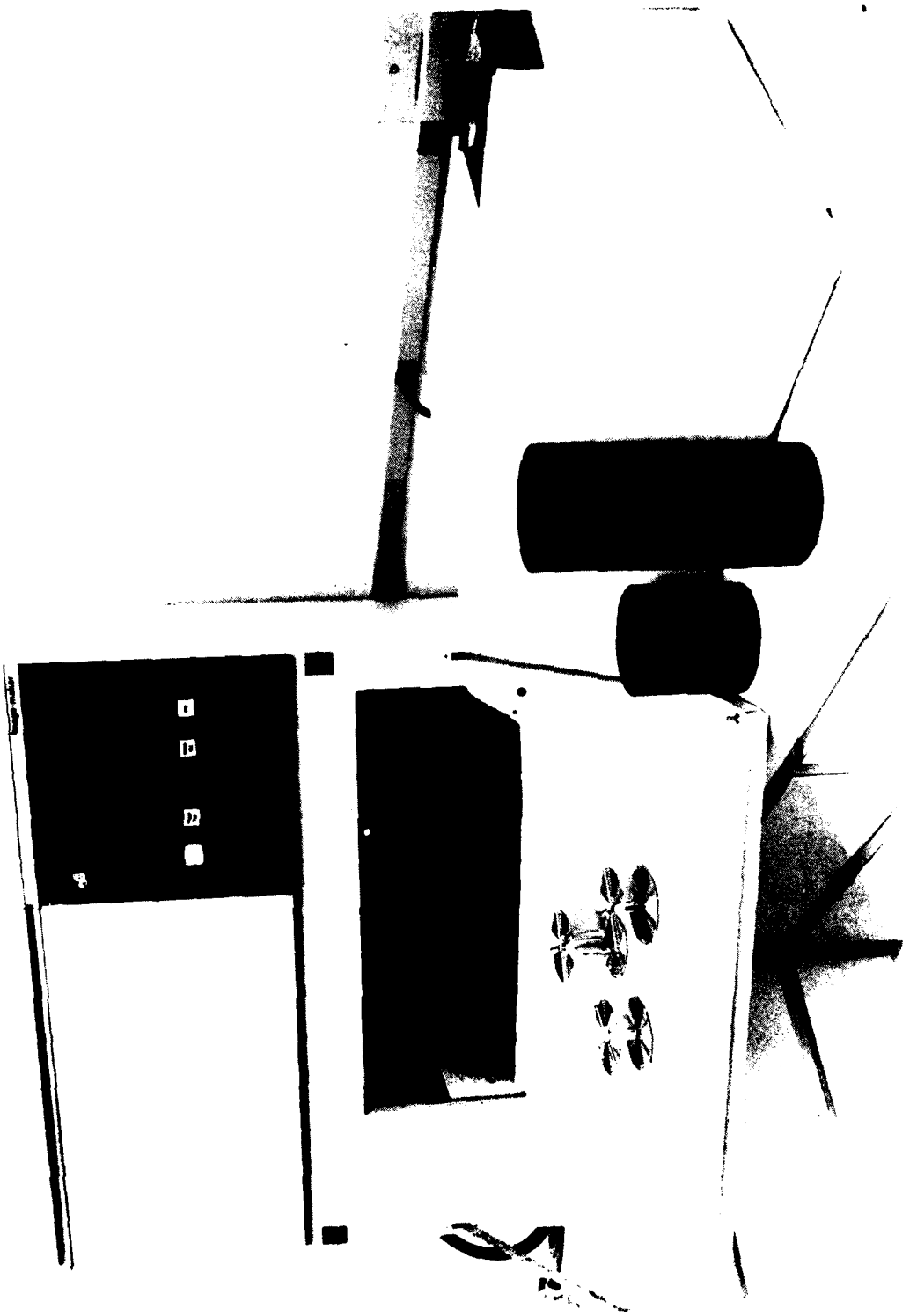

Figure C-8. Film/Print Processor

Figure C-9. Film Chain Unit

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